



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>5</sup> B26B 19/00, 21/00, B23K 26/00 A1 (11) International Publication Number: WO 92/16338  
(43) International Publication Date: 1 October 1992 (01.10.92)

(21) International Application Number: PCT/GB92/00426 Published  
(22) International Filing Date: 10 March 1992 (10.03.92) *With international search report.*

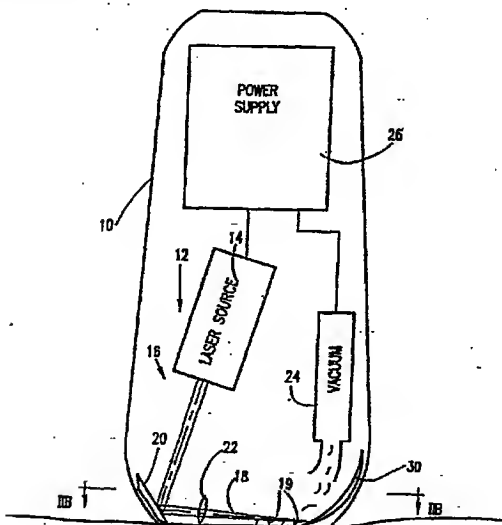
(30) Priority data: 97531 12 March 1991 (12.03.91) IL

(71/72) Applicant and Inventor: KELMAN, Elliot [GB/GB]; 44 Western Avenue, London NW11 9PR (GB).

(74) Agent: FREED, Arthur, Woolf; Reginald W. Barker & Co., 13 Charterhouse Square, London EC1M 6BA (GB).

(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, Bj (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC (European patent), MG, ML (OAPI patent), MN, MR (OAPI patent), MW, NL, NL (European patent), NO, PI, RO, RU, SD, SE, SE (European patent), SN (OAPI patent), TD (OAPI patent), TG (OAPI patent), US.

(54) Title: HAIR CUTTING APPARATUS



(57) Abstract

Hair cutting apparatus including a housing (10) and laser apparatus (12) disposed in the housing (10) and arranged to provide a beam of light (18) impinging on hair (19) to be cut, the beam of light (18) being operative to cut the hair (19).

**FOR THE PURPOSES OF INFORMATION ONLY**

**Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.**

AT	Austria	FI	Finland	MI	Mali
AI	Australia	FR	France	MN	Mongolia
BB	Barbados	GA	Gabon	MR	Mauritania
BE	Belgium	GB	United Kingdom	MW	Malawi
BF	Burkina Faso	CN	Guinea	NL	Netherlands
BC	Bulgaria	CR	Costa Rica	NO	Norway
BJ	Benin	HU	Hungary	PL	Poland
BR	Brazil	IE	Ireland	RO	Romania
CA	Canada	IT	Italy	RU	Russian Federation
CF	Central African Republic	JP	Japan	SD	Sudan
CC	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland	KR	Republic of Korea	SN	Senegal
CI	Cote d'Ivoire	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
CS	Czechoslovakia	LU	Luxembourg	TG	Togo
DE	Germany	MC	Monaco	US	United States of America
DK	Denmark	MD	Madagascar		
ES	Spain				

## HAIR CUTTING APPARATUS

The present *invention* relates to hair cutting apparatus generally.

-i

## BACKGROUND OF THE INVENTION

There exists a great variety of hair cutting apparatus. These include single or multiple blade razors which are pulled across the surface of the skin *and* devices having an electrically powered vibratory element which drives opposing blades in a scissors type action.

U.S. Patent 3,934,115 describes a method *and* apparatus for electric singe cutting in which heated and opposed edges of two thin strips of metal form a slot, at which hair extending therethrough is singed to effect severance of the hair.

## SUMMARY OF THE INVENTION

The present invention seeks to provide improved hair cutting apparatus.

There is thus provided in accordance with a preferred embodiment of the present invention hair cutting apparatus including a housing and laser apparatus disposed in the housing and arranged to provide a beam of light impinging on hair to be cut, the beam of light-being operative to cut the hair.

In accordance with a preferred embodiment of the present invention, the laser apparatus is operative to provide a beam of light at a wavelength which is strongly absorbed by hair to be cut but, not strongly absorbed by adjacent tissue.

In accordance with a preferred embodiment of the present invention, the wavelength of the beam is such that it is generally not *absorbed* by human skin.

A preferred wavelength range for operation of the shaving apparatus is 0.8 micron.

In accordance with a preferred embodiment of the invention the operational wavelength of the laser apparatus is selected to be such that only hairs of a certain color, such as white or gray hairs, are cut and the remainder of the hairs are not cut. A wavelength of 0.8 micron is suitable for this purpose. - Such apparatus may be particularly useful **for** removing unwanted white or gray hairs automatically.

In accordance with a preferred embodiment of the present invention, the laser apparatus also comprises optical transfer means for directing the beam to the hair. The optical transfer means may include refraction and reflection means having-

optical power.

Additionally in accordance with a preferred embodiment of the invention, hair collection apparatus may also be provided in the housing for collecting loose hairs that have been cut by the laser beam. The hair collection apparatus may comprise a vacuum device or alternatively or additionally, electrostatic hair collection apparatus.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully'from the following detailed description, taken in conjunction with the drawings in which:

Fig. 1A is a pictorial illustration of the use of a shaver constructed and operative in accordance with a preferred embodiment of the present invention;

Fig. 1B is a pictorial illustration of the use of a laser hair cutter constructed and operative in accordance with a preferred embodiment of the present invention;

Fig. 2A is a simplified sectional illustration of a laser shaver constructed and operative in accordance with a preferred embodiment of the present invention.

Fig. 2B is a simplified sectional illustration taken along the lines 2B - 2B of Fig. 2A;

Fig. 3A is a simplified sectional illustration of a laser shaver constructed and operative in accordance with another preferred embodiment of the present invention;

Fig. 3B is a simplified sectional illustration taken along the lines 3B - 3B of Fig. 3A; and

Fig. 4 is a simplified sectional illustration of a laser hair cutter constructed and operative in accordance with another preferred embodiment of the present invention.

## DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Reference is now made to Figs. 1A, 2A and 2B which illustrate a laser shaver constructed and operative in accordance with a preferred embodiment of the present invention. The laser shaver preferably comprises a housing 10, typically formed of plastic or of any other suitable material. Disposed within housing 10 is laser apparatus 12, preferably comprising a laser source 14 and laser beam transfer optics 16, which direct a laser beam 18, produced by the laser source 14 to hairs 19 to be cut.

In accordance with a preferred embodiment of the present invention, the laser source 14 comprises a semiconductor laser such as a Gallium Arsenide laser, preferably operative to provide an output laser beam at a wavelength which is strongly absorbed by hair, such as facial hair but which is not strongly absorbed by surrounding tissue, such as skin. A preferred wavelength is 0.8 micron. although it is assumed that other wavelengths may also be suitable.

It is a particular-feature of the present invention that suitable selection of the operative wavelength of the laser source 14 enables hair to be vaporized and carbonized at the location of impingement of the laser beam 18 thereon. thus separating that portion of the hair still attached to the hair follicle from that extending outward from the impingement location, thereby producing a hair cutting effect.

It is also a particular feature of the present invention that by suitable selection of the operative wavelength of the laser source only hair of a selectable color or range of colors may be cut, while hairs of other colors are left

intact. In such a way white or gray hair may be automatically removed by a simple combing action.

The laser beam transfer optics 16 preferably comprise reflective optics, such as a mirror 20 and refractive optics such as a lens 22. Any other suitable arrangement of laser beam transfer optics 16, including any suitable optical element or elements may alternatively be employed.

In accordance with one preferred embodiment of the present invention, there is also provided a laser beam absorber 30 for absorbing the laser beam and thus preventing spurious impingements thereof.

Reference is now made to Figs. 3A and 3B which illustrate a preferred embodiment of laser shaver in which the laser beam transfer optics is designed to provide multiple reflections of the laser beam over a shaving region. In this case, the absorber 30 is replaced by at least two mirrors 32 and preferably a generally rectangular circumferential mirror assembly which is operative to provide a back and forth pattern of laser beams, which can be effective for cutting hair over a relatively large area. It is appreciated that in this embodiment, initial impingement of the laser beam on mirror 20 is such as to produce a reflection which is not perpendicular to the planes of mirrors 32.

According to a preferred embodiment of the present invention, there is provided apparatus for collecting loose hairs, which are cut by the impingement thereon of laser beam 18. The apparatus for collecting loose hairs preferably comprises



electrically operated vacuum apparatus 24, such as a suction blower but may alternatively comprise any other suitable 'hair collection apparatus, such as electrostatic apparatus.

Both the laser source 12 and the vacuum apparatus may receive electrical power from a suitable power supply 26, which may be battery powered or alternatively powered by an external source of current.

Reference is now made to Fig. 4, which illustrates hair cutting apparatus constructed and operative in accordance with a preferred embodiment of the present invention and comprising many of the same elements as in the embodiment of Figs. 2A, 2B, 3A and 3B, which are indicated by identical reference numerals. In the embodiment of Fig. 4, there is provided a comb portion 40 which arranges the hairs 42 on a person's head, generally in a plane so that they can be impinged upon by a laser beam 18, which may be focussed thereon by a lens 22. Alternatively lens 22 may be eliminated. As a further alternative additional optical apparatus may be provided for positioning or configuring the laser beam, directing it along multiple paths or effecting scanning thereof.

It is a particular feature of the embodiment of Fig. 4, that color specific cutting may be provided, thus enabling white or gray hairs to be automatically cut, while leaving uncut dark colored hair. Additionally or alternatively, a hair thinning function may be provided, whereby only a desired percentage of all hairs may be cut by the laser beam.

It will be appreciated by persons skilled in the art that the present invention is not limited to what has been particularly shown and described hereinabove. Rather the scope of the present invention is defined only by the claims which follow:

## C L A I M S

1. Hair cutting apparatus comprising a housing and laser means disposed in the housing and arranged to provide a beam of light impinging on hair to be cut, the beam of light being operative to cut the hair.
2. Hair cutting apparatus according to claim 1 and wherein said laser means is operative to provide a beam of light at a wavelength which is strongly absorbed by hair to be cut but not strongly absorbed by adjacent tissue.
3. Hair cutting apparatus according to claim 2 and wherein said wavelength of the beam is such that it is generally not absorbed by human skin.
4. Hair cutting apparatus according to any of the preceding claims and wherein said wavelength of the beam is such that it is generally absorbed by hair in a predetermined color range but is not generally absorbed by hair outside of said color range.
5. Hair cutting apparatus according to claim 4 and wherein said wavelength is such that it is generally absorbed by white and gray hair, producing cutting thereof but is not generally absorbed by hair of other colors.
6. Hair cutting apparatus according to any of claims 2 - 5 and wherein said wavelength is 0.8 micron.

7. Hair cutting apparatus according to any of claims 1 - 6 and wherein said laser means also comprises optical transfer means for directing the beam to the hair.
8. Hair cutting apparatus according to claim 7 and wherein said optical transfer means includes refraction and reflection means having optical power.
9. Hair cutting apparatus according to any of the preceding claims and also comprising hair collection means in the housing for collecting loose hairs that have been cut by the laser beam.
10. Hair cutting apparatus according to claim 9 and wherein said hair collection means comprises a vacuum device..
11. Hair cutting apparatus according to any of claims 7 - 10 and wherein said optical transfer means comprise means for producing multiple reflections of said laser beam.
12. Hair cutting apparatus according to any of claims 7 - 11 and wherein said optical transfer means comprise means for focusing said laser beam.
13. A method for color selectively cutting hair comprising the steps of:
- providing a laser beam having a wavelength which is % strongly absorbed by hair of a predetermined color range, which

hair it is sought to cut and which is not strongly absorbed by hair of a color outside of the predetermined color range, which it which is sought not to cut; and

causing the laser beam to impinge on hair for cutting those hairs of said predetermined color range while not cutting those hairs of a color outside of the predetermined color range.

115

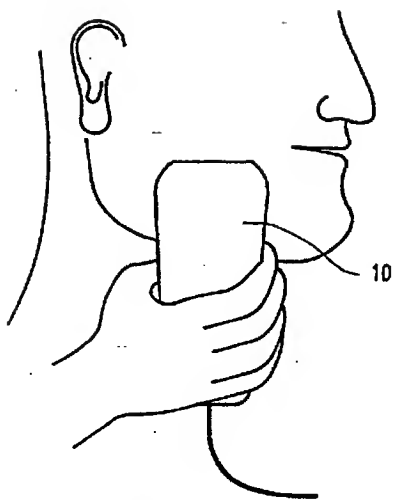


FIG. 1A

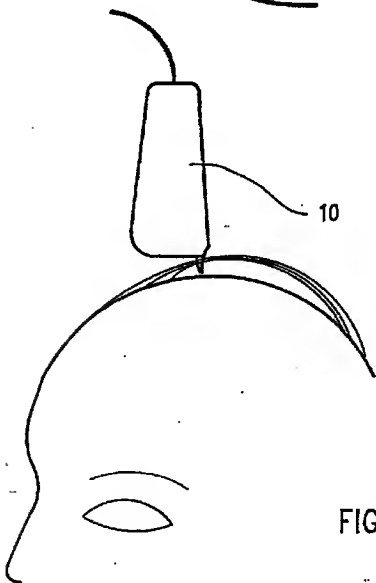


FIG. 1B

2f5

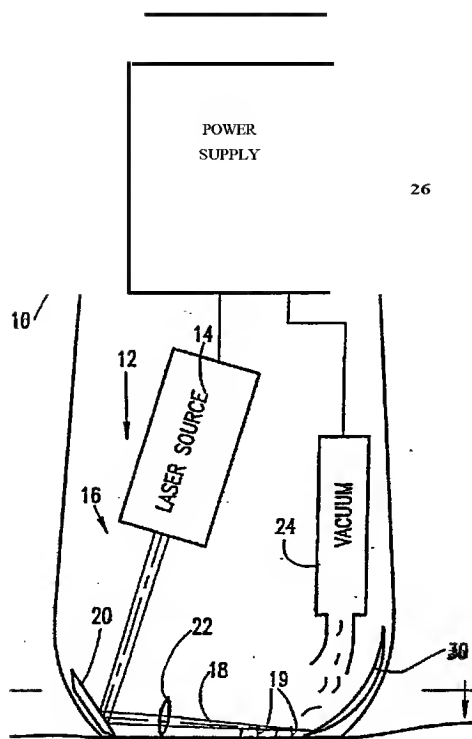
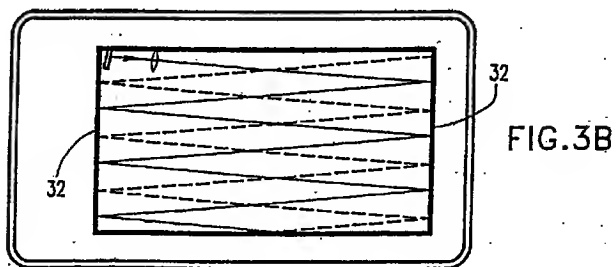
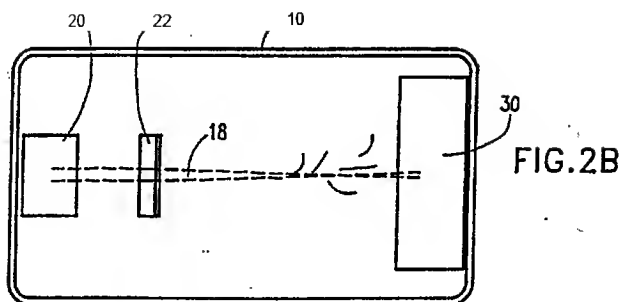


FIG.2A

3/5





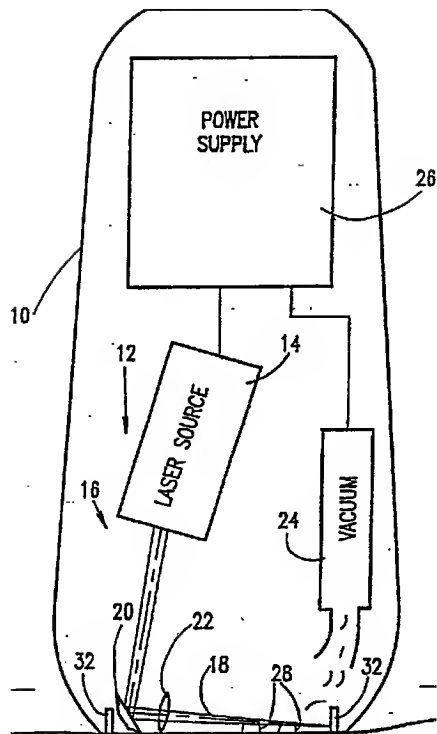
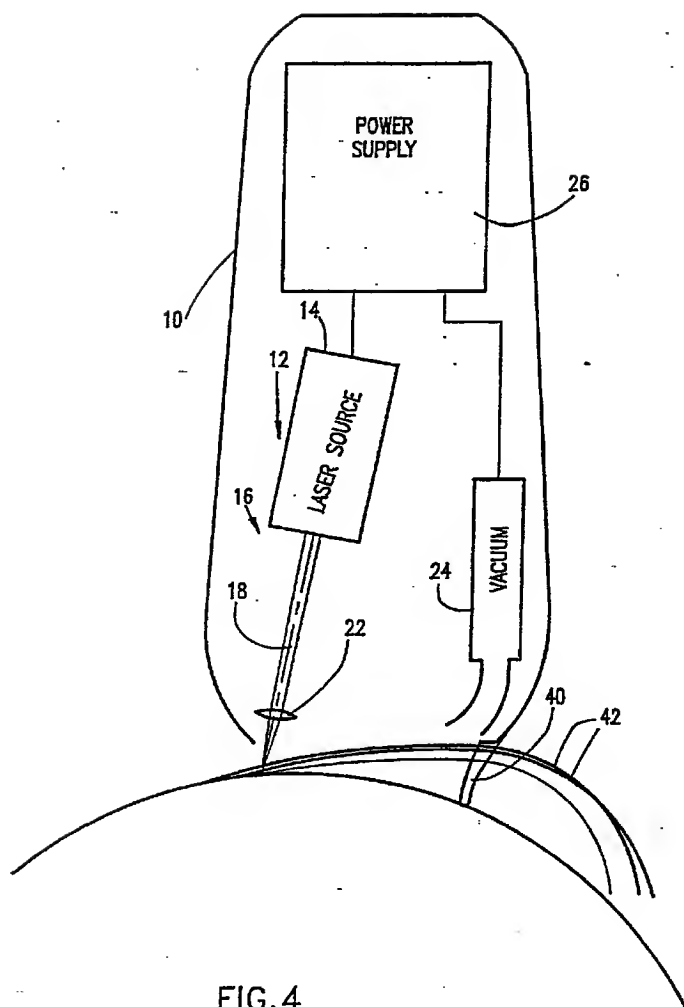


FIG.3A

5/5



L CLASSIFICATION OF SUBJECT MATTER (If several classification systems apply, mention all) According to International Patent Classification (EP) or to both National Classification and IPC Int.Cl. 5 B26B19/00; B26B21/00; B23K26/00		
D. FIELDS SEARCHED		
Minimum Documentation Senda		
Gssination System	Classification Symbols	
Int.Cl. 5	B26B ; B23K ; A61B	
Doameaidou San'bed other than Norma Docla.ataiba to the Extent that such Documents are laNol in la the Fields Searched		
M. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Qatloa of Dormant, " with Moans, Inure aptepr a, of th. Wozm passages a	Llama to Chin NoP
P,X	WO,A,9 106 406 (SIMON) 16 May 1991	1-5,7,8, 12
P,Y	see page 3, line 36 - page 5; claims; figures	9,10
Y	US,A,4 578 558 (J. E. CLEGG) 25 March 1986 see figures 1-5,14 see column 1, line 39 - column 2, line 63 see column 4, line 30 - line 53	9,10
A		1,7,8,12
X	US,A,4 051 760 (M. GLENNAN) 4 October 1977 see figure 1 see column 2, line 30 - column 3, line 2 -/--	1
<p>I Spedal asgorin of dad doormats :<sup>10</sup> A' dousaeest defining the vental note of the art which is act oanand of 'mordant Mona= of Jccrrt bat published on or attar the iat.oatloal flUng date I doormat which ray throw doubts oatr/ dahs(s) or which is died to establish the p date of NORM citation or Other special reason (as specified) O' doormed refiring to as teal d arm% ray addbtdoa or other ace's P' doormat pab&amp;Wed prior to the Intonational Ming date bet later dlm the priority due dual</p> <p>later document published altar the latradcad Ping date or plenty data sad sot l. mallet with the auntlea bat diod to "Winston/ the plod" or Meaty oad that War'm doormat of particular rehar". the dolmen taeasdoas coms be coidgrad aowd or moot be coasidrad to lasolaw u smtive stop Y' doormat of potdalar reloraaal the dilated Irma". maw be considered to involve as tawadr. sop when the document it maned wi ere or more ether such does- ma's, sack mshhsdas bong obvious to a porne skilled la the on. tit' doourest toolbar of the sass patent family</p>		
IV. CERTIFICATION		
Due of the Actimi Completios of the Iatsratlo.al Search 10 JUNE 1992		Date of Mailing of this Idwaadwi Stench Rapert 3 O. OE 92
taraatleal Searching Authority EUROPEAN PATENT OFFICE		Sipiamre of Authorized Ci <sup>9</sup> ar ir = RAVEN P.

## M. DOCUMENTS CONSIDERED TO BE RELEVANT

(CONTINUED FROM THE SECOND SHEET)

Category

Citation of Document, with Indication, where appropriate, of the relevant passages

Relevant to Claim No.

A

US, A, 4 819 669 (E. POLITZER) 11 April 1989  
see column 1, line 48 - column 2, line 41;  
figures 1, 5  
see column 3, line 34 - column 4, line 32  
see column 5, line 24 - column 6



ANNEX TO THE INTERNATIONAL SEARCH REPORT GB 9200426  
ON INTERNATIONAL PATENT APPLICATION NO. SA 57336

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. -  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 10/06/92

Patent document cited in search report	Publication date	Patent family number(s)	Publication date
W0-A-9106406	16-05-91	DE-A- EP-A- 3936367 0452459	08-05-91 23-10-91
US-A-4578558	25-03-86	None	
US-A-4051760	04-10-77	AU-A- AU-A- 8246575 8246475	06-01-77 06-01-77
US-A-4819669	11-04-89	FR-A- FR-A- EP-A,B WO-A- JP-T- 2579446 2583331 0215878 8605676 62502724	03-10-86 19-12-86 01-04-87 09-10-86 22-10-87